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NNSA Minority Serving Institute Partnership Program (MSIPP)— Indigenous Mutual Partnership to Advanced Cybersecurity Technology (ASPIRE, IMPACT and PAMER)

FY22 Q2 Progress Report

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ABSTRACT

The following report summarizes the status update during this quarter for the National Nuclear Security Agency (NNSA) initiated Minority Serving Institution Partnership Plan's (MSIPP) projects titled, Indigenous Mutual Partnership to Advanced Cybersecurity Technology (ASPIRE), Indigenous Mutual Partnership to Advanced Cybersecurity Technology (IMPACT) and Partnership for Advanced Manufacturing Education and Research (PAMER).

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EXECUTIVE SUMMARY

In 2016, the National Nuclear Security Agency (NNSA) initiated the Minority Serving Institution Partnership Plan (MSIPP) targeting Tribal Colleges and Universities (TCUs) to offer programs that will prepare students for technical careers in NNSA's laboratories and production plants. The MSIPP consortium's approach is as follows: 1) align investments at the college and university level to develop a curriculum and workforce needed to support NNSA's nuclear weapon enterprise mission, and 2) to enhance research and education at under-represented colleges and universities.

The first TCU consortium that MSIPP launched was known as the Advanced Manufacturing Network Initiative (AMNI) whose purpose was to develop additive manufacturing (AM) learning opportunities. The AMNI consortium consisted of Bay Mills Community College, Cankdeska Cikana Community College, Navajo Tech University, Salish Kootenai Community College, Turtle Mountain Community College, and United Tribes Technical College. In 2016, the American Indian Higher Education Consortium (AIHEC), the AMNI consortium and the Southwestern Indian Polytechnic Institute (SIPI), in collaboration with Sandia National Labs, using a grant by NNSA hosted the first TCU Advanced Manufacturing Technology Summer Institute (TCU AMTSI). The AMNI consortium will officially end Sept. 2022. However, building on the successes of AMNI, in FY22 NNSA's MSIPP launched three additional consortiums:

- the Advanced Synergistic Program for Indigenous Research in Engineering (ASPIRE), which focuses on STEM and the electrical and mechanical engineering skills set needed for renewable and distributed energy systems,
- the Indigenous Mutual Partnership to Advanced Cybersecurity Technology (IMPACT), which focuses on STEM and cybersecurity, and
- the Partnership for Advanced Manufacturing Education and Research (PAMER), which focuses on developing and maintaining a sustainable pathway for a highly trained, next-generation additive manufacturing workforce and a corresponding community of subject matter experts for NNSA enterprises.

The following report summarizes the status update during this quarter for Partnership for Advanced Manufacturing Education and Research (ASPIRE, IMPACT and PAMER).

ACRONYMS AND DEFINITIONS

Abbreviation	Definition
ABET	Accreditation Board for Engineering and Technology
AIHEC	American Indian Higher Education Consortium
AM	advanced manufacturing
AMNI	advanced manufacturing network initiative
BMCC	Bay Mills Community College
CAD	Computer Aided Design
CCCC	Cankdeska Cikana Community College
COVID-19	corona virus disease 2019
EAB	Engineering Advisory Board
ENR	Engineering
GPS	Global positioning system
MSIPP	Minority Serving Institution Partnership Plan
NDSU	North Dakota State University
NPC	Navigation Pointing & Control
NNSA	National Nuclear Security Agency
NTU	Navajo Technical University
R&D	research and development
ROV	remotely operated vehicle
SKC	Salish Kooteani College
STEM	science, technology, engineering, and mathematics
TCUs	Tribal Colleges and Universities
TMCC	Turtle Mountain Community College
UTTC	United Tribes Technical College

1. TRIBAL COLLEGES AND UNIVERSITIES

The overall goals of the ASPIRE, IMPACT, and PAMER consortia are to establish a network of TCUs, private sector businesses and federal agencies that focus on science, technology, engineering and mathematics (STEM) to partner in preparing an American Indian workforce and create economic and employment opportunities within Tribal communities. The specific technical focus of each consortia are as follows:

1. ASPIRE focuses on developing the electrical and mechanical engineering skills specific to the renewable and distributed energy industry.
2. IMPACT focuses on developing the computer science and computer engineering skills specific to the cybersecurity industry.
3. PAMER focuses on developing and maintaining a sustainable highly trained American Indian workforce for next-generation advanced manufacturing (AM) and a corresponding community of subject matter experts for NNSA enterprises. Specific goals of the PAMER consortium are to:
    a. significantly increase the American Indian graduates hired into NNSA/DOE's STEM workforce via STEM activities,
    b. provide advanced manufacturing experiential learning for K-12, undergrad and graduate students,
    c. enable TCUs to work collaboratively with national laboratories subject matter experts to increase TCU/MSI interactions with DOE/NNSA, and
    d. advance the scientific and technical knowledge of advanced manufacturing as related to NNSA/DOE mission.

1.1. Advanced Synergistic Program for Indigenous Research in Engineering (ASPIRE)

Turtle Mountain Community College (TMCC) is the lead and United Tribes Technical College (UTTC) will serve as the partner MSI for ASPIRE, collectively funded at one million dollars ($1M) per year over the next five years. Other TCUs categorized as passive participants, since they did not receive direct funding from MSIPP, include Sitting Bull College, Nueta Hidatsa Sahnish College, and Cankdeska Cikana Community College. Sandia National Laboratories (Sandia) will provide technical advising, planning, and academic program development support for the ASPIRE consortium.

Sandia will also coordinate with TMCC and UTTC to provide a meaningful ASPIRE Academy program in 2022. The ASPIRE Academy will target students who are not yet eligible for the summer internships with the national laboratories (i.e., GPAs < 3.0). The goal of the Academy is to make American Indian students aware of career opportunities in STEM and renewable and distributed energy. Sandia provides technical assistance to each of the TCUs regarding their current renewable, distributed energy and STEM activities. Sandia will also provide summer internship opportunities to qualifying students.

1.2. Indigenous Mutual Partnership to Advanced Cybersecurity Technology (IMPACT)

Turtle Mountain Community College (TMCC) is the lead and United Tribes Technical College (UTTC) will serve as the partner MSI for IMPACT, collectively funded at one million dollars ($1M)

per year over the next five years. Sandia National Laboratories (Sandia) working closely with the American Indian Higher Education Consortium (AIHEC) will provide technical advising, planning, and academic program development support for the IMPACT consortium and is funded at $200K per year for the next five years.

Sandia will also coordinate with TMCC and UTTC to provide a meaningful 2022 Cybersecurity Summer Camp for 11th and 12th graders entering the 2022-23 school year. The goal of the program is to make American Indian students aware of career opportunities in STEM and cybersecurity. Sandia will provide technical assistance to each of the TCUs regarding their current cybersecurity activities.

1.3. Partnership for Advanced Manufacturing Education and Research (PAMER)

The Navajo Technical University (NTU) is the lead Minority Serving Institution (MSI) and partner MSIs are Southwestern Indian Polytechnic Institute (SIPI), Nebraska Indian Community College (NCC) and University of Texas at El Paso (UTEP) for PAMER, collectively funded at one million dollars ($1M) per year over the next five years. Partner national laboratories are Sandia National Laboratories (SNL), Oak Ridge National Laboratory (ORNL), and Los Alamos National Laboratory (LANL). Sandia National Laboratories (Sandia) will provide technical advising, planning, and academic program development support for the PAMER consortium. In addition, Sandia will provide summer internship opportunities.

2. TURTLE MOUNTAIN COMMUNITY COLLEGE

Turtle Mountain Community College (TMCC) is a tribal college located in Belcourt, North Dakota. TMCC was founded by the Turtle Mountain Band of Ojibwa in 1972. There are over 25,000 enrolled members, 34 percent of whom live on or near the Tribe's 86,989 acres. TMCC offers Associate of Science degrees, also known as "transfer" degrees because they satisfy the lower division general education requirements for baccalaureate degrees at main stream universities in North Dakota State institutions.

Courses offered at TMCC related to ASPIRE include intro to engineering, intro to additive manufacturing, statics, dynamics, calculus, statistics, and physics. TMCC also has courses that support cybersecurity and data privacy program prepares students for entry-level positions in cybersecurity and data privacy. Graduates will be prepared to become leaders in cybersecurity, with a solid understanding of security technology and privacy laws, preparing them to make knowledgeable and responsible decisions. The program also offers students a transfer option to four-year institutions.

3. UNITED TRIBES TECHNICAL COLLEGE

United Tribes Technical College (UTTC) is located in Bismarck, North Dakota (ND), It was established in 1969 by an association of ND's Native tribes and it offers certificate programs and two-year degrees in over 20 programs of study.

One of UTTC's focus areas is computer information technology. Upon completion of the Computer Information Technology program, graduates will be prepared for employment as an Information Security Analyst, Network Architect, Computer Support Specialist, Database Administrator, or a Systems Administrator. Information Technology (IT) professionals will be ready to take the next step forward and seek the certifications in networking, IT technical support and

security. IT students will study networking fundamentals and computer hardware design in-depth, securing a local network, programming skills, and server applications.

4. NAVAJO TECHNICAL UNIVERSITY

Navajo Technical University (NTU) is a tribally controlled postsecondary career and technical institution in Crownpoint, New Mexico. Two smaller campuses are in Chinle, Arizona and Teec Nos Pos, Arizona. The NTU campuses are located on the Navajo Reservation. NTU offers programs focusing on advanced manufactured (AM) metal parts, certification of 3D metal printed parts, and inspection methodologies and techniques including equipment operation and optical metrology including testing and characterization of materials.

Of significant note, in August 2018 NTU obtained accreditation from the Accreditation Board of Engineering and Technology (ABET) for its industrial engineering and electrical engineering programs. Having an ABET accreditation is important because it significantly increases employment opportunities for graduates of those programs. NTU was the first TCU to achieve ABET accreditation. Since becoming ABET-accredited, the NTU Engineering Advisory Board (EAB) chaired by Sandia's Stan Atcitty continues to focus on sustaining the ABET accreditation and strategically expanding programs to include other disciplines such as Chemical and Mechanical Engineering.

5. SOUTHWESTERN INDIAN POLYTECHNIC INSTITUTE (SIPI)

The Southwestern Indian Polytechnic Institute (SIPI) in Albuquerque, New Mexico, is a National Indian Community College and Land Grant Institution that provides high quality technical and higher education opportunities to American Indians and Native Alaskan Students. Its goal is to produce students ready to enter the local technological workforce and to contribute to society at large. SIPI offers excellent associate degree programs in Engineering and Engineering Technology for American Indians.

6. NEBRASKA INDIAN COMMUNITY COLLEGE

Nebraska Indian Community College (NICC) is a public tribal land-grant community college with three locations in Nebraska: Macy on the Omaha Tribe reservation, Santee on the Santee Sioux reservation, and the urban South Sioux City. NICC offers an Associate of Science in General Science Studies (GSS) that provides opportunities for personal and career enrichment, primarily designed to allow students to transfer their work to a four-year college. NICC's GSS program supports the Math and Science general education class requirements that include four-hour lecture and lab classes. It is also designed to provide STEM classes for Math and Science majors that allow students to create areas of focused interest, while still establishing a strong STEM base, rooted in indigenous science, as well as mainstream science. This strong Math and Science educational base enables our graduates to pursue employment after their two-year degree or transfer to other higher education institutions to pursue higher level degrees. This program promotes life-long learning with a holistic lens of the world.

7. UNIVERSITY OF TEXAS AT EL PASO (UTEP)

UTEP is one of the largest and most successful Hispanic-serving institutions in the country, with a student body that is 83% Hispanic. UTEP enrolls nearly 25,000 students in 166 bachelor's, master's and doctoral programs in 10 colleges and schools. With more than $100 million in total annual

research expenditures, UTEP is ranked in the top 5% of research institutions nationally and fifth in Texas for federal research expenditures at public universities.

UTEP offers undergraduate degrees in a wide variety of STEM disciplines. It's engineering departments offers the following undergraduate degrees: civil engineering, computer science, electrical and computer engineering, engineering education and leadership, industrial, manufacturing and systems engineering, mechanical engineering, and metallurgical, materials and biomedical engineering. UTEP offers a M.S. and Ph.D. in mechanical engineering, and a graduate certificate in 3D engineering and advanced manufacturing.

8. QUARTERLY UPDATES

The following section captures descriptions of activities we accomplished during the current quarter. Table 1 contains a summary of all activities we covered up to this point in the fiscal year.

Table 1 FY22 Quarterly Updates Sandia's contributions to each of the TCUs

Quarter	Updates
1	Funding was released in November 2021. Project kick-off meeting was held on November 03, 2021 via Zoom. Planning underway for the ASPIRE Academy. ASPIRE background, goals and objectives were provided to key Sandia management in preparation of the summer internship program
1	Funding was released January 2022. Planning underway for the 2022 Cybersecurity Camp. Cybersecurity camp for 11-12 graders will be held June 27-July 1, 2022 at TMCC. Hybrid in-person/virtual presentations will be made available for Sitting Bull College and Stone Child Community College. Sandia will provide background on cybersecurity activities and career opportunities. See appendix A for flyer.
2	Students from TMCC, UTCC and Sitting Bull College toured SNL and LANL facilities on March 3-4, 2022.
2	Sandia's Stan Atcitty visited four North Dakota TCUs, March 28-31, 2022: 1) North Dakota State University, 2) Cankeska Cikana Community college, 3) Turtle Mountain Community College and 4) United Tribes Technical College.
2	Sandia will hire 8 MSIPP students for summer 2022. The majority will be working on-site at Sandia Albuquerque during summer 2022. Some will be working hybrid (onsite and telecommute).
3	
4	

9. SANDIA IS WORKING TO EXPAND ITS MSIPP NETWORK

Sandia's Tribal Energy Security team met with Tamaya Ventures and Southwest Indian Polytechnic Institute (SIPI) to discuss potential collaboration between all three parties. The meeting occurred on January 18, 2022 at SIPI in Albuquerque, NM. Representatives from Sandia facilitated discussions between Tamaya Ventures and SIPI to form a mutually beneficial relationship between the two parties going forward. As part of the next steps outlined in the meeting Sandia will host several technical outreach events during Q2 and Q3 of FY22.

9.1. Students Visited Sandia National Laboratories

On March 4, 2022 the ASPIRE program at Sandia National Laboratories hosted nine students and three advisors (figure 1) from four TCU's (United Tribes Technical College, Turtle Mountain Community College, Candeska Cikana Community College, and Sitting Bull College). This was the last part of a multi-day tour that included the Kansas City National Security Campus, New Mexico Office and Los Alamos National Laboratories. During the visit students met with Native American professionals while touring Sandia's unique laboratories.

The day started with a personal welcome from Sandia's director, James Peery, who spent almost an hour discussing Sandia's mission and hearing from the students. After the welcome, the students were treated to three, hour-long tours covering distinct topics. The three tours included:

- Distributed Energy Technologies Lab
- Robotics Lab
- Advanced Manufacturing Lab

During lunch, members from Sandia's American Indian Outreach Committee discussed their motivations for working at a national laboratory and the path they took to get there. Additionally, one of the managers, Karen McDaniel (Navajo), discussed what she looks for in an internship application and how to make applications stand out.

We received positive feedback from the students and advisors and have had several debrief meetings since the tour. During quarter 3, we will shift ASPIRE's focus towards a summer academy for students and future visits with national laboratory staff at their respective colleges.

Figure 1 Students and advisors from North Dakota colleges and universities with their Sandia hosts.

9.2. Sandia's Stan Atcitty Visited Students at North Dakota Colleges and Universities

Sandia's MSIPP program lead, Stan Atcitty, visited the following North Dakota TCUs during the week of 28 March 2022: 1) North Dakota State University, 2) Cankeska Cikana Community college, 3) Turtle Mountain Community College and 4) United Tribes Technical College. The following provides a quick summary of each visit.

9.2.1. North Dakota State University, March 28, 2022, Fargo, ND

On 28 March, Stan and one of Sandia's year-round student interns met with four tribal students at NDSU. Three of these students are majoring in mechanical engineering and the fourth is majoring in computer engineering. Stan had lunch with the students and addressed questions they had regarding career paths during this brief visit. Also, Stan got to meet in person one of the students Sandia is planning on hiring for the summer.

9.2.2. Cankeska Cikana Community College, March 29, 2022, Fort Totten, ND

On 29 March, Stan visited CCCC in Fort Totten, ND where he gave a presentation to four faculty members and six students including the Academic Dean and Kim Paulson who is the Carpentry instructor. The six students were from the Carpentry Certificate Program. Stan shared a broad overview of his experiences and talked to the students about their own educational pathways and future careers. He also provided advise on resumes and interviews.

9.2.3. Turtle Mountain Community College, March 29, 2022, Belcourt, ND

On 30 March, Stan met with six cybersecurity students and two faculty members from Turtle Mountain Community College. Each of these students are members of the Turtle Mountain Chippewa Indian Band. During this visit, Stan gave an overview of Sandia National Labs and the opportunities available to students. The students were engaged and asked many questions regarding the types of projects they might work on. In general, students were enthusiastic about the opportunities at Sandia wanted to pursue internships. Figure 2 shows Stan with some of the students who attended his presentation at TMCC.

Figure 2 Stan Atcitty with Turtle Mountain Community College Students

9.2.4. United Tribes Technical College, March 30, 2022, Bismarck, ND

On 31 March, Stan met with UTTC president, Dr. Leander McDonald to provide an overview of the MSIP TCU program and discuss current students. Stan also met with nine students where he shared his personal journey with the students, provided background on Sandia, talked about his technical leadership, and provided insights on resumes and interviews. The students' majors are as follows: two from business, three from pre-engineering and four from environmental science. These students represent six different tribes. During this visit, the students asked many questions and gained professional, technical and personal knowledge. Stan also met with a pre-engineering student from Sitting Bull College. Figure 3 shows Stan providing a lecture and motivational speech to UTTC students.

Figure 3 Stan providing a lunch-time lecture and motivational speech to UTTC students

10. ASPIRE ACADEMY

The ASPIRE Academy will target students who are not eligible for summer internships with the National Laboratories (GPAs < 3.0). The enrolled students will spend three weeks in Fargo ND completing various coursework such as ENR 290 Manufacturing Processes, ENR 275 Digital Systems, ENR 204 Surveying with lab, etc., touring labs at NDSU, and touring a local industry. Upon completion of the three weeks in Fargo, students will spend a week at UND touring their labs and facilities, in addition to exploring local industry there as well. The final four weeks will find the students at UTTC to work on research projects developed by the National Laboratory Partners that culminates in a presentation to the partners.

11. SANDIA'S 2022 SUMMER HIRES

Majority of the 8 new MSIPP students will be working on-site at Sandia Albuquerque during summer 2022. Some will be working hybrid (onsite and telecommute). Three students are returning from prior MSIPP involvement and will be supported by Sandia projects.

Table 2 Sandia's Planned 2022 Summer Hires

Number of Students	University
3	Navajo Tech
1	North Dakota State
1	Montana State
1	Sitting Bull College
1	Salish Kootenai College
1	Turtle Mountain Community College

12. 2022 TCU CYBERSECURITY TECHNOLOGY SUMMER CAMP

The 2022 TCU Cybersecurity Summer Camp will be held on the TMCC campus. Sandia will work closely with the TCU, the MSIs (TMCC and UTTC), to provide guidance regarding the 2022 Cybersecurity Camp for high school students. The eight-week program is planned for June 27 through July 1, 2022 (see appendix A). Sandia, with close coordination with TMCC, will provide training sessions on cybersecurity, and career opportunities. The institute will host American Indian students representing local TCUs (from TMCC, Sitting Bull College and Stone Child Community College). The following provides a brief overview of the topic areas.

13. FIRST TCU CONSORTIUM CONTINUES TO BENEFIT STUDENTS

The following updates highlight individuals who participated as students in the previous TCU Advanced Manufacturing Network Initiative (AMNI) consortium and Sandia's summer intern programs. This is encouraging news because it demonstrates the sustainability of the MSIP Programs.

Table 3 Success Stories: Students that participated in the Advanced Manufacturing Network Initiative

Name	School	Update
Candidate 1	NTU	Recently accepted a Year-round Intern position at Sandia. This candidate's new position at Sandia is funded by a non-MSIPP sponsor
Candidate 2	NTU	Recently accepted a full-time staff member in Sandia's Critical Skills Program. This program will provide the candidate the opportunity to continue their education, fully funded including a stipend. They will be a full-time student working towards a Master of Science in Computer Engineering at University of New Mexico. Upon completing their degree, this candidate will take on projects with the hiring organization, Inertial Systems and Avionics.
Candidate 3	NDSU/ CCCC	Accepted a Year-round Intern position at Sandia in an organization focusing on mechanical design
Candidate 4	NTU	In the process of applying to a limited-term employee (LTE) position in Sandia's Applied Science and Tech Maturation department.

14. CONCLUSION

All three projects are on schedule. The funding for ASPIRE, IMPACT and PAMER is active. Students and faculty from North Dakota TCUs visited Sandia on 4 March 2022 and Stan Atcitty visited their campuses the week of 28 March 2022. Currently, we are planning the summer 2022 ASPIRE Academy and the 2022 Cybersecurity Camp. Discussions with each of the respective TCUs regarding various technical assistance is on-going.

APPENDIX A. 2022 CYBERSECURITY CAMP FLYER

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